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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/521,055

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Manabu Nishimura

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EXAMINER

FIDLER, SHELBY LEE

ART UNIT	PAPER NUMBER
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2861

MAIL DATE	DELIVERY MODE
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10/18/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/521,055

Applicant(s)

NISHIMURA ET AL.

Examiner

Shelby Fidler

Art Unit

2861

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 September 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-49 is/are pending in the application.
- 4a) Of the above claim(s) 29-49 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6, 8, 9, 11-18 and 24-26 is/are rejected.
- 7) ☒ Claim(s) 7, 10, 19-23, 27 and 28 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 January 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 1/12/05, 8/20/07, 9/12/07.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Applicant's election of Group I in the reply filed on 9/10/2007 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claims 29-49 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected distinct group of claims, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 9/10/2007.

Claim Objections

Claim 10 is objected to as seemingly failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. This claim states that the remaining parts of the sacrifice layer are electrically connected to the electrode, so that they are at the same potential. Examiner notes that parent claim 1 provides the antecedent basis for the claimed "said electrode" of claim 10. However, this electrode corresponds to electrode 12a, whereas the instant specification states only that the remaining parts are electrically connected to the dummy electrodes 12b (pages 61-63 of instant specification). Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4, 6, 8, 9, 11, 17, 25, and 26 are rejected under 35 U.S.C. 102(b) as being anticipated by Abe (US 6406133 B1).

Regarding claim 1:

Abe discloses an electrostatic actuator comprising:

a substrate (electrode substrate 21);

an electrode (individual electrode 22) formed on said substrate (Fig. 13B);

a plurality of partition parts (insulating film 41) formed on said electrode (Fig. 13B);

a vibration plate (diaphragm 12b) formed on said partition parts (Fig. 13B), said vibration plate being deformable by an electrostatic force generated by a voltage applied to said electrode (col. 13, lines 52-56); and

an air gap (gap G – col. 13, lines 50-52) formed between said plurality of partition parts by etching a part of a sacrifice layer (insulating film 41) formed between said electrode and said vibration plate, wherein said partition parts comprise remaining parts of said sacrifice layer after said etching (col. 8, line 52 – col. 9, line 5 and Figs. 2A-2C).

Examiner notes that the method of forming a device is not germane to the issue of patentability of the device itself, and limitations concerning the method of forming are given

Art Unit: 2861

only as much weight in an apparatus claim as is essential to produce the structure of the device itself.

Regarding claim 2:

Abe also discloses that the substrate is a silicon substrate (col. 8, lines 11-12).

Regarding claim 3:

Abe also discloses dummy electrodes (gap spacers 22' - col. 8, lines 29-31) at positions corresponding to the partition parts (Fig. 13B), the dummy electrodes being electrically separated from the electrode by separation grooves (Fig. 13B).

Regarding claim 4:

Abe also discloses that the sacrifice layers (41) is formed of silicon oxide (col. 8, lines 12-14).

Regarding claim 6:

Abe also discloses that an insulating layer is formed on the electrode (col. 8, lines 40-44), and the separation grooves are filled with the insulating layer (filling of the grooves is inherent to the thermal oxidation process described in col. 8, lines 40-51).

Regarding claim 8:

Abe also discloses that the sacrifice layer (41) is divided by separation grooves (L-shaped grooves formed in insulating layer 41 that are shown in Fig. 13B), and an insulating layer (diaphragm 12a acts to insulate the gap from the ink pressure chamber 13) is formed on the sacrifice layer so that the separation grooves are filled with the insulating layer (Fig. 13B).

Regarding claim 9:

Abe also discloses that a thickness of the insulating layer (12a) is equal to or greater than one half of a width of each of the separation grooves (as shown in Fig. 13B).

Art Unit: 2861

Regarding claim 11:

Abe also discloses that the sacrifice layer (41) is formed of a conductive material (silicon oxide – all materials are conductive), and the dummy electrodes (22') serve as a part of electric wiring (Fig. 13B).

Regarding claim 17:

Abe also discloses that a distance of the air gap measured in a direction perpendicular to a surface of the electrode facing the vibration plate is substantially 0.2 microns (col. 8, lines 16-19).

Regarding claim 25:

Abe also discloses that an insulating layer (insulating film 42) is formed on a surface of the vibration plate facing the electrode (Fig. 21), wherein a thickness of the insulating layer near a center between the partition parts adjacent to each other is larger than a thickness of the insulating layer near the partition parts (col. 16, lines 22-34 and Fig. 21).

Regarding claim 26:

Abe also discloses that an insulating layer (insulating film 42) is formed on the electrode (col. 16, lines 31-34), wherein a thickness of the insulating layer near a center between the partition parts adjacent to each other is larger than a thickness of the insulating layer near the partition parts (col. 16, lines 22-34 and Fig. 21).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

Art Unit: 2861

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 5, 14, 15, 18, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Abe (US 6406133 B1) in view of Koeda (US 6425656 B1).

Regarding claim 5:

Abe discloses all claimed limitations except that the electrode is formed of a material selected from a group consisting of polysilicon, aluminum, titanium, titanium nitride, titanium silicide, tungsten, tungsten silicide, molybdenum, molybdenum silicide, and ITO.

However, Koeda disclose forming electrodes out of ITO (col. 6, lines 54-57).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize electrodes made of ITO, such as disclosed by Koeda, into the invention of Abe. One motivation for doing so, as taught by Koeda, is to be able to observe the conditions of etching the sacrificial layer (col. 6, lines 54-57).

Regarding claim 14:

Abe discloses all claimed limitations except that a through hole is formed in the vibration plate for removing by etching the parts of the sacrifice layer through the through hole so as to form the air gap.

However, Koeda discloses a through hole (window 212) that is formed in a vibration plate (diaphragm 201) for removing by etching the parts of a sacrifice layer through the through hole so as to form an air gap (col. 6, lines 51-61).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a through hole in the vibration plate, such as disclosed by Koeda, into

Art Unit: 2861

the invention of Abe. One motivation for doing so, as taught by Koeda, is to form air gaps with high precision so that it is possible to drive the actuator with a low driving voltage (col. 2, lines 38-43).

Regarding claim 15:

Koeda also discloses that the through hole (212) is located near the partition parts (Fig. 1).

Regarding claim 18:

Koeda also discloses that a plurality of the through holes (212) are arranged along a longer side of the vibration plate at an interval that is equal to or less than a length of the shorter side of the vibration plate (Fig. 1).

Regarding claim 24:

Koeda also disclose a member (partition 213) that is joined to an upper surface of the vibration plate (Fig. 2), wherein the through hole is sealed by a joining surface of the member (Fig. 2).

Claims 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Abe (US 6406133 B1) in view of Tanaka (US 6508539 B2).

Regarding claim 12:

Abe discloses all the limitations of claim 1, as well as the limitations that the actuator further comprises insulating layers (insulating films 42 and 43) on the electrode and a surface of the vibration plate facing the electrode (col. 15, lines 11-15), wherein the insulating layers are formed of silicon oxide (e.g. col. 8, lines 40-43).

Art Unit: 2861

Abe does not disclose that the sacrificing layer is formed of one of polysilicon and amorphous silicon.

However, Tanaka discloses a layer formed on an electrode that is formed of polysilicon (polysilicon oxide film 52 and Fig. 9).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize the polysilicon electrode and insulating layer materials disclosed by Tanaka, into the invention of Abe. One motivation for doing so, as taught by Tanaka, is to be able to form high accuracy gaps with satisfactory yield without needing to increase the drive voltage (col. 13, line 64 – col. 14, line 15).

Regarding claim 13:

Abe discloses all the limitations of claim 1, as well as the limitation that the sacrificing layer is formed of silicon oxide.

Abe does not disclose that the electrode is formed of polysilicon.

However, Tanaka discloses an electrode formed of polysilicon (polysilicon layer 51), and an insulating layer formed of silicon oxide (polysilicon oxide 52 – col. 13, lines 60-63 and Fig. 9).

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Abe (US 6406133 B1).

Regarding claim 16:

Abe also disclose that the vibration plate has substantially a rectangular shape (Figs. 13A and 13B).

Abe does not expressly disclose that a shorter side of the vibration plate is equal to or less than 150 microns.

However, it would have been an obvious matter of design choice to form a vibration plate with a shorter side of less than 150 microns, since such a modification would have involved a mere change in the size of a component. A change in size is generally recognized as being within the level of ordinary skill in the art. In re Rose, 105 USPQ 237 (CCPA 1955).

Allowable Subject Matter

Claims 7, 10, 19-23, and 27-28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 7 contains allowable subject matter since the prior art of record does not disclose, teach, or suggest an electrostatic actuator comprising an insulating layer, wherein a thickness of the insulating layer is equal to or greater than one half of a width of each of the separation grooves. It is this limitation, in combination with other features and limitations of claim 7, which makes this claim allowable over the prior art of record.

Claim 10 contains allowable subject matter since the prior art of record does not disclose, teach, or suggest an electrostatic actuator comprising a sacrifice layer that is formed of a conductive material, and the remaining parts of the sacrifice layer are electrically connected to one of the substrate, the electrode, and the vibration plate so that the remaining parts are at the same potential with the one of the substrate, the electrode, and the vibration plate. It is this limitation, in combination with other features and limitations of claim 10, which makes this claim allowable over the prior art of record.

Art Unit: 2861

Claims 19-23 contain allowable subject matter since the prior art of record does not disclose, teach, or suggest an electrostatic actuator comprising a resin film that is formed on a surface opposite to a surface facing the electrode, wherein the through hole is sealed by the resin film of the member. It is this limitation, in combination with other features and limitations of claim 19, which makes these claims allowable over the prior art of record.

Claims 27-28 contain allowable subject matter since the prior art of record does not disclose, teach, or suggest an electrostatic actuator comprising a cavity that is formed between the electrode and the substrate, and the electrode has a connection through hole connected the cavity to the air gap. It is this limitation, in combination with other features and limitations of claim 27, which makes this claim allowable over the prior art of record.

Communication with the USPTO.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelby Fidler whose telephone number is (571) 272-8455. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Luu can be reached on (571) 272-7663. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2861

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Shelby L. Fidler 10/10/2007

Shelby Fidler
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